Tetra Tech EM Inc.

6801 Engle Road, Suite G ◆ Middleburg Heights, Ohio 44130 ◆ (440) 234-0886 ◆ FAX (440) 234-1725

June 15, 2001

Mr. Joe Fredle
On-Scene Coordinator
Emergency Response Branch
U.S. Environmental Protection Agency Region 5
25089 Center Ridge Road
Westlake, OH 44145

Subject: **Letter Report**
Cleveland Hopkins International Airport Site
Brook Park, Cuyahoga County, Ohio
Technical Direction Document No. S05-0012-008
Tetra Tech Contract No. 68-W-00-129

Dear Mr. Fredle:

The Tetra Tech EM Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) submits the enclosed letter report for the Cleveland Hopkins International Airport site in Brook Park, Cuyahoga County, Ohio. If you have any questions or comments about the report or require additional copies, please contact me at (440) 234-1049 or Thomas Kouris at (312) 946-6431.

Sincerely,

Bill Kosco
Tetra Tech START Project Manager

Enclosure

cc: Lorraine Kosik, U.S. EPA START Program Officer
Thomas Kouris, Tetra Tech START Program Manager

Tetra Tech EM Inc.

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LETTER REPORT
CLEVELAND HOPKINS
INTERNATIONAL AIRPORT SITE
BROOK PARK, CUYAHOGA COUNTY, OHIO

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY
Region 5 Emergency Response Branch
25089 Center Ridge Road
Westlake, OH 44145

TDD No.:	S05-0012-008
Date Prepared:	June 15, 2001
Contract No.:	68-W-00-129
Prepared by:	Tetra Tech EM Inc.
START Project Manager:	Bill Kosco
Telephone No.:	(440) 234-1049
EPA On-Scene Coordinator:	Joe Fredle
Telephone No.:	(440) 250-1740

CONTENTS

FIGURE

TABLES

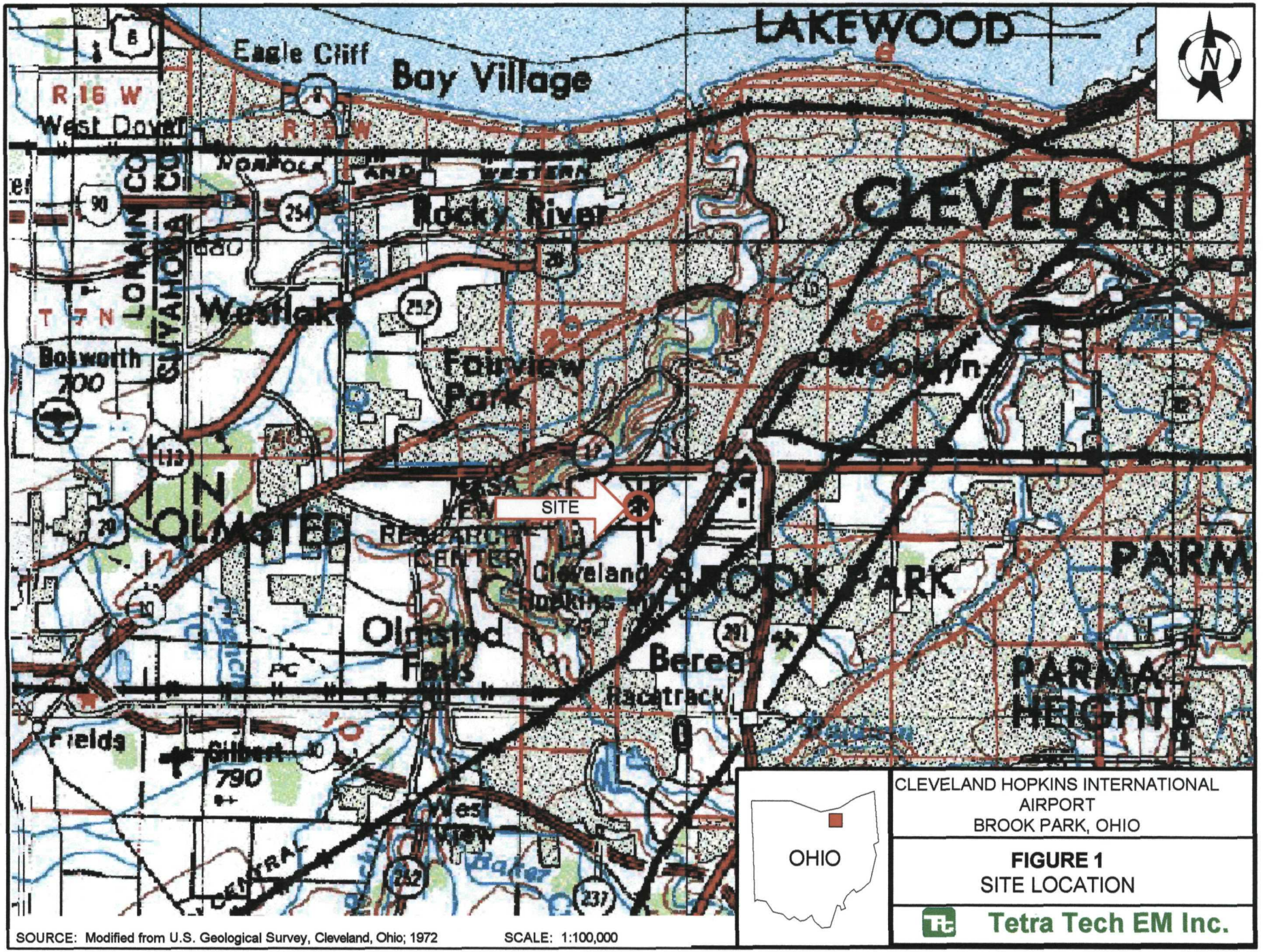
1.0 INTRODUCTION

The Tetra Tech EM Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) prepared this letter report in accordance with the requirements of Technical Direction Document (TDD) No. S05-0012-008, issued by the U.S. Environmental Protection Agency (U.S. EPA). The scope of this TDD was to conduct water sampling and field measuring and monitoring activities at the Cleveland Hopkins International Airport (CHIA) site in Brook Park, Cuyahoga County, Ohio. START was tasked to (1) document on-site conditions through written logbook notes and still camera photographs (Appendix A); (2) collect water samples; (3) perform field screening; (4) perform analytical data validation (see Appendix B), (5) determine flow velocity and discharge rates at several outfalls (Appendix C); and (6) prepare a letter report. Sampling and field measurment activities were conducted by Tetra Tech START member Bill Kosco. This report discusses the background (Section 2.0), sampling and field activities (Section 3.0), analytical results (Section 4.0), and presents a summary for the sampling event that occured on April 12, 2001 (Section 5.0).

2.0 BACKGROUND

The CHIA site is at 5300 Riverside Drive in Brook Park, Cuyahoga County, Ohio. The geographical coordinates of the site are 41° 24' 44.1" N and 81° 50' 8.8" W. Figure 1 shows the location of the CHIA site.

On April 12, 2001, U.S. EPA and Tetra Tech START conducted water sampling and field measuring and monitoring activities at CHIA outfalls 001, 004, 005, 007, 008, and 009. U.S. EPA and START conducted air monitoring for hydrogen sulfide (H_2S), lower explosive limit (LEL), and percent oxygen using a Rae System's MultiRAE detector (MultiRAE). Air monitoring also was conducted using a Drager pump with various selected detection tubes including mercapton, nitroglycol, and ammonia. Water samples were collected and sent to EIS Analytical Services, Inc. (EIS), in South Bend, Indiana, for ammonia, propylene glycol, ethylene glycol, and H_2S analyses. The samples also were field screened for ammonia using an EM Quant test kit and for H_2S using a HACH HS-C test kit. U.S. EPA and START also conducted flow rate studies and measured the dimensions of the outfall discharge or captured a portion of the discharge in a graduated bucket to determine discharge rates and contaminant mass loadings.



SOURCE: Modified from U.S. Geological Survey, Cleveland, Ohio; 1972 SCALE: 1:100,000

CLEVELAND HOPKINS INTERNATIONAL AIRPORT
BROOK PARK, OHIO

FIGURE 1
SITE LOCATION

Tetra Tech EM Inc.

3.0 SAMPLING AND FIELD ACTIVITIES

On April 12, 2001, U.S. EPA and START conducted water sampling and field measuring and monitoring activities at the CHIA site. START also calculated the contaminant loadings for each outfall based on the field measurements recorded during the sampling event and the validated laboratory data. Table 1 shows the outfall contaminant concentrations, discharge flow rates, and contaminant mass loadings for the sampling event. Appendix C presents hand-written calculations for discharge flow rates and contaminant mass loadings for each outfall. The sampling and field measuring and monitoring activities are discussed in the following paragraphs.

At 0900 on Thursday, April 12, 2001, U.S. EPA and START met at the National Aeronautics and Space Administration (NASA) facility because CHIA outfalls 004, 005, 007, 008, and 009 are located on NASA's property. U.S. EPA and START met with Dan Papkey of NASA who was responsible for providing an escort for U.S. EPA and START to sample the CHIA outfalls. Outfall 001 is not located on NASA property; therefore, an escort was unnecessary during the sampling and field measuring and monitoring activities at this outfall.

At 1000, U.S. EPA and START arrived at outfall 005 (Photograph Nos. 1 and 2). U.S. EPA informed START that no readings above background were detected with the MultiRAE or the Drager tubes; however, ammonia was detected in the outfall discharge at a concentration of 30 milligrams per liter (mg/L). In addition, START detected H_2S in the outfall sample at a concentration of 0.1 mg/L. The measured velocity at outfall 005 was 2.52 feet per second (fps), and the flow rate and discharge rate were calculated at 65.0 cubic feet per minute (cfm) and 486 gallons per minute (gpm), respectively.

At 1100, U.S. EPA and START arrived at outfall 004 (Photograph No. 3). U.S. EPA informed START that no readings above background were detected with the MultiRAE or the Drager tubes; however, ammonia was detected in the outfall discharge at a concentration of 30 mg/L. START detected an H_2S concentration of 0.1 mg/L. The measured velocity at outfall 004 was

TABLE 1

CONTAMINANT CONCENTRATIONS, FLOW RATES, AND CONTAMINANT LOADINGS IN OUTFALLS 001, 004, 005, 007, 008, AND 009 ON APRIL 12, 2001

Sampling Location	Nitogen as Ammonia Concentration (mg/L)	Ethylene Glycol Concentration (mg/L)	Propylene Glycol Concentration (mg/L)	H_2S Concentration (mg/L)	Discharge Rate (gpm)	Ammonia Loadings (lbs/day)	Ethylene Glycol Loadings (lbs/day)	Propylene Glycol Loadings (lbs/day)
Outfall 001	10.0	19.0	190.0	<0.1[a]	54.6	6.5	12.5	115
Outfall 004	14.0	<3.0[a]	<3.0[a]	<0.1[a]	94.0	15	NC	NC
Outfall 005	15.0	9.9	340.0	<0.1[a]	486	87	58	1,985
Outfall 007	4.80	120.0	210.0	<0.1[a]	305	17	440	769
Outfall 008	8.00	<3.0[a]	<3.0[a]	<0.1[a]	66.0	6.3	NC	NC
Outfall 009	1.60	19.0	<3.0[a]	<0.1[a]	21.8	0.38	5.0	NC

Notes:

mg/L	=	Milligrams per liter
H_2S	=	Hydrogen sulfide
gpm	=	Gallons per minute
lbs/day	=	Pounds per day (24-hour period)
<	=	Less than
a	=	The compound was reported at less than the required detection limit value.
NC	=	Not calculated since the compound was reported less than the required detection value.

Contaminant concentrations and loadings are based on validated laboratory data.

0.57 fps and the flow rate and discharge rate were calculated at 12.6 cfm and 94.0 gpm, respectively.

At 1155, U.S. EPA and START arrived at outfall 009 (Photograph No. 4). U.S. EPA informed START that no readings above background were detected with the MultiRAE or Drager tubes. U.S. EPA and START also did not detect any ammonia or H_2S in the outfall samples. U.S. EPA and START used a graduated bucket to capture the flow at outfall 009 and calculated a discharge rate of 21.8 gpm.

At 1245, U.S. EPA and START arrived at outfall 007 (Photograph No. 5). U.S. EPA informed START that no readings above background were detected with the MultiRAE or Drager tubes; however, ammonia was detected in the outfall discharge at a concentration of 20 mg/L. In addition, START detected H_2S in the outfall discharge at a concentration of 0.1 mg/L. The measured velocity at outfall 007 was 2.52 fps and the flow rate and discharge rate were calculated at 40.8 cfm and 305 gpm, respectively.

At 1300, U.S. EPA and START arrived at outfall 008 (Photograph No. 6). U.S. EPA informed START that no readings above background were detected with the MultiRAE or Drager tubes; however, ammonia was detected in the outfall discharge at a concentration of 20 mg/L. In addition, START detected H_2S in the outfall discharge at a concentration of 0.1 mg/L. The measured velocity at outfall 008 was 2.45 fps and the flow rate and discharge rate were calculated at 8.82 cfm, and 66.0 gpm, respectively.

At 1400, U.S. EPA and START arrived at outfall 001 north (Photographs No. 7) . U.S. EPA informed START that no readings above background were detected with the MultiRAE or Drager tubes; however, ammonia was detected in the outfall discharge at a concentration of 20 mg/L. START did not detect any H_2S in the outfall sample. U.S. EPA and START used a graduated bucket to capture the flow at outfall 001 north and calculated a discharge rate of 54.6 gpm.

EPA and START left the site at 1500.

4.0 ANALYTICAL RESULTS

START received analytical results for six water samples collected from the CHIA outfalls. The samples were analyzed by EIS using U.S. EPA Method 350.1 for nitogen as ammonia analysis, SW-846 Method 8015 for ethylene and propylene glycol analyses, and SW-846 Method 9034 for sulfide analysis. The data validation memorandum that includes the analytical results is presented in Appendix B.

Ammonia as nitrogen was detected in each of the outfall samples and ranged in concentration from 1.60 to 15.0 mg/L; ethylene glycol was detected in outfall samples 001, 005, 007, and 009 and ranged in concentration from 9.90 to 120 mg/L; and propylene glycol was detected in outfall samples 001, 005, and 007 and ranged in concentration from 190 to 340 mg/L. H_2S was not detected in any of the outfall samples (see Table 1).

5.0 SUMMARY

On Thursday, April 12, 2001, U.S. EPA and START conducted water sampling and field measuring and monitoring activities at six outfalls at the CHIA site in Brook Park, Cuyahoga County, Ohio. The water sampling and field measuring and monitoring activities were conducted at outfalls 001, 004, 005, 007, 008, and 009. The outfall water samples were analyzed by EIS using U.S. EPA Method 350.1 for nitrogen as ammonia analysis, SW-846 Method 8015 for ethylene and propylene glycol analyses, and SW-846 Method 9034 for sulfide analysis. The outfall discharge rates and contaminant loadings also were calculated based on the field measurements and the laboratory-validated data (see Table 1).

START does not anticipate further activities under this TDD.

APPENDIX A

PHOTOGRAPHIC LOG

(Seven Pages)

OFFICIAL PHOTOGRAPH NO. 1
U.S. ENVIRONMENTAL PROTECTION AGENCY

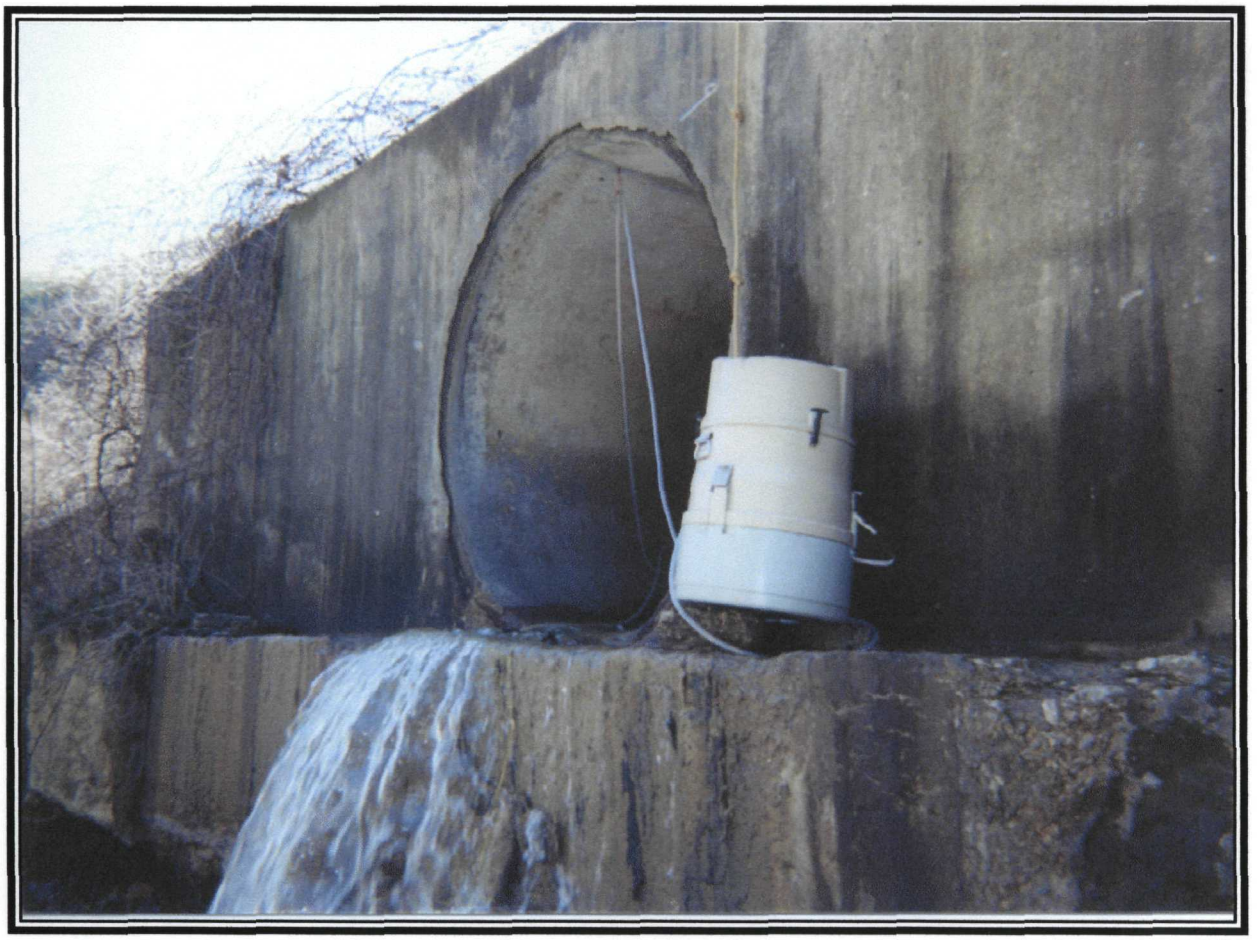
Subject: Outfall 005

Location: Cleveland Hopkins International Airport Site
Brook Park, Cuyahoga County, Ohio

Orientation: East

TDD No.: S05-0012-008 **Date:** April 12, 2001

Photographer: Bill Kosco, START



OFFICIAL PHOTOGRAPH NO. 2
U.S. ENVIRONMENTAL PROTECTION AGENCY

Subject:	Outfall 005		
Location:	Cleveland Hopkins International Airport Site Brook Park, Cuyahoga County, Ohio		
Orientation:	North		
TDD No.:	S05-0012-008	**Date:**	April 12, 2001
Photographer:	Bill Kosco, START		

OFFICIAL PHOTOGRAPH NO. 3
U.S. ENVIRONMENTAL PROTECTION AGENCY

Subject: Outfall 004

Location: Cleveland Hopkins International Airport Site
Brook Park, Cuyahoga County, Ohio

Orientation: South

TDD No.: S05-0012-008 **Date:** April 12, 2001

Photographer: Bill Kosco, START

OFFICIAL PHOTOGRAPH NO. 4
U.S. ENVIRONMENTAL PROTECTION AGENCY

Subject:	Outfall 009		
Location:	Cleveland Hopkins International Airport Site Brook Park, Cuyahoga County, Ohio		
Orientation:	North		
TDD No.:	S05-0012-008	**Date:**	April 12, 2001
Photographer:	Bill Kosco, START		

OFFICIAL PHOTOGRAPH NO. 5
U.S. ENVIRONMENTAL PROTECTION AGENCY

Subject:	Outfall 007		
Location:	Cleveland Hopkins International Airport Site Brook Park, Cuyahoga County, Ohio		
Orientation:	South		
TDD No.:	S05-0012-008	**Date:**	April 12, 2001
Photographer:	Bill Kosco, START		

OFFICIAL PHOTOGRAPH NO. 6
U.S. ENVIRONMENTAL PROTECTION AGENCY

Subject:	Outfall 008		
Location:	Cleveland Hopkins International Airport Site Brook Park, Cuyahoga County, Ohio		
Orientation:	South		
TDD No.:	S05-0012-008	**Date:**	April 12, 2001
Photographer:	Bill Kosco, START		

OFFICIAL PHOTOGRAPH NO. 7
U.S. ENVIRONMENTAL PROTECTION AGENCY

Subject: Outfall 001 North

Location: Cleveland Hopkins International Airport Site
Brook Park, Cuyahoga County, Ohio

Orientation: Southwest

TDD No.: S05-0012-008 **Date:** April 12, 2001

Photographer: Bill Kosco, START

APPENDIX B

VALIDATED ANALYTICAL DATA MEMORANDUM

(Seven Pages)

Tetra Tech EM Inc.
200 E. Randolph Drive, Suite 4700 ◆ Chicago, IL 60601 ◆ (312) 856-8700 ◆ FAX (312) 938-0118

MEMORANDUM

Date: 02 May 01

To: William Kosko, Project Manager, Tetra Tech EM Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) for Region 5

From: Lisa Graczyk, Chemist, Tetra Tech START for Region 5

Subject: Data Validation for
Hopkins Airport Site
Wilmington, Ohio
Analytical Technical Direction Document (TDD) No. S05-0104-008
Project TDD No. S05-0012-008

Laboratory: EIS Analytical Services, Inc. (EIS), South Bend, Indiana
Work Order No. 010400111
Ethylene Glycol, Propylene Glycol, Hydrogen Sulfide, and Ammonia Analysis of Six Water Samples

1.0 INTRODUCTION

The Tetra Tech START for Region 5 validated ethylene glycol, propylene glycol, hydrogen sulfide, and ammonia analytical data for six water samples collected on 12 Apr 01 during a site evaluation of the Hopkins Airport site in Wilmington, Ohio. The samples were analyzed under the above-referenced work order by EIS, using U.S. Environmental Protection Agency (EPA) SW-846 Method 8015 for ethylene glycol and propylene glycol analysis, Method 350.1 for nitrogen as ammonia analysis, and SW-846 Method 9034 for sulfide analysis.

The organic data (ethylene glycol and propylene glycol data) were validated in general accordance with the EPA's "Contract Laboratory Program National Functional Guidelines for Organic Data Review" dated Oct 99. Data validation consisted of a review of the following quality control (QC) parameters:

holding times, gas chromatograph (GC) instrument performance check, initial and continuing calibrations, blank results, matrix spike and matrix spike duplicate sample (MS/MSD) results, laboratory control sample (LCS) results, internal standard results, and target compound identification.

The analyses for ammonia and sulfide were validated in general accordance with "Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" dated Feb 94. Data validation for ammonia and sulfide consisted of a review of the following QC parameters: holding times, initial and continuing calibrations, and blank results.

Section 2.0 discusses the results of the organic data validation, Section 3.0 discusses the results of the ammonia and sulfide data validation, and Section 4.0 presents an overall assessment of the data. The attachment contains EIS's summary of sample analytical results.

2.0 ORGANIC DATA VALIDATION RESULTS

The results of START's data validation for ethylene glycol and propylene glycol are summarized below in terms of the QC parameters reviewed.

2.1 HOLDING TIMES

All samples were analyzed within the holding time limit of 14 days for volatile organic compound (VOC) analysis.

2.2 GC INSTRUMENT PERFORMANCE CHECK

The peak resolutions on the gas chromatograms produced by the instrument were adequate.

2.3 INITIAL AND CONTINUING CALIBRATIONS

The relative standard deviation from the initial calibration was within the QC limit of less than or equal to 20 percent as required by SW-846 Method 8015. The continuing calibration results were within the QC limit of less than or equal to 15 percent difference between the initial calibration relative response factor and the continuing calibration relative response factor as required by SW-846 Method 8015.

2.4 BLANK RESULTS

A method blank was run with the analytical batch and in the proper sequence. No target analytes were detected in the blank at concentrations exceeding the instrument detection limit.

2.5 MS/MSD RESULTS

An MS and MSD were analyzed with the samples. The percent recoveries for the MS and MSD and the relative percent difference (RPD) between the MS and MSD were within the QC limits set by the laboratory (60 to 140 percent recovery and 0 to 20 RPD) except for propylene glycol which had a MSD recovery of 162 percent in the duplicate and a RPD of 31 between the MS and MSD. The recovery of the MS for propylene glycol was 119 percent. No qualification was applied for this irregularity.

2.6 LCS RESULTS

An LCS was analyzed with the samples, and results were within the QC limits of 60 to 140 percent recovery.

2.7 INTERNAL STANDARD RESULTS

The area counts for the internal standard were within the QC limits of -50 percent to +100 percent from

the calibration standard. The retention times of the internal standard were within the QC limit of ± 30 seconds.

2.8 TARGET COMPOUND IDENTIFICATION

Review of the sample chromatograms revealed that peaks were found at the appropriate retention times for ethylene glycol and propylene glycol for those samples with positive results for these compounds.

3.0 DATA VALIDATION RESULTS FOR AMMONIA AND SULFIDE ANALYSES

The results of START's data validation for ammonia and sulfide analyses are summarized below in terms of the QC parameters reviewed.

3.1 HOLDING TIMES

All samples were analyzed within the holding time limit of 28 days for ammonia and 7 days for the sulfide analysis.

3.2 INITIAL AND CONTINUING CALIBRATIONS

Quality control limits are not specified for the ammonia analysis for calibrations. However, the initial calibration had a linear regression of 0.99924 and the continuing calibration had a recovery of 93 percent which is acceptable.

There are no calibrations applicable to the sulfide analysis which is a titrimetric procedure.

3.3 BLANK RESULTS

Blanks were analyzed with the analyses for ammonia and sulfide. No target analytes were detected in the blank at concentrations exceeding the instrument detection limit.

4.0 OVERALL ASSESSMENT OF DATA

The overall quality of the data generated by EIS is acceptable for use without qualifications.

ATTACHMENT

EIS SUMMARY OF SAMPLE ANALYTICAL RESULTS

(One Page)

SAMPLE RESULTS

Client Name: Tetra Tech EM, Inc.
Client Project: Hopkins Airport

Report Date: 4/25/01
EIS Order No: 010400111

EIS Lab Number	Client Description	Sample Date	Parameter	Result	Units	RDL	Test Date	Analyst	Method
074950	Outfall 001	4/12/01	Ethylene Glycol	19	mg/L	3	4/16/01	CarlsenS	8015 M
		4/12/01	Nitrogen(Ammonia)	10	mg/L	0.05	4/18/01	SzkarlatM	350.1
		4/12/01	Propylene Glycol	190	mg/L	3	4/16/01	CarlsenS	8015 M
		4/12/01	Sulfide,Total	<0.1	mg/L	0.1	4/16/01	SzkarlatM	9034
074951	Outfall 004	4/12/01	Ethylene Glycol	<3	mg/L	3	4/16/01	CarlsenS	8015 M
		4/12/01	Nitrogen(Ammonia)	14	mg/L	0.05	4/18/01	SzkarlatM	350.1
		4/12/01	Propylene Glycol	<3	mg/L	3	4/16/01	CarlsenS	8015 M
		4/12/01	Sulfide,Total	<0.1	mg/L	0.1	4/16/01	SzkarlatM	9034
074952	Outfall 005	4/12/01	Ethylene Glycol	9.9	mg/L	3	4/16/01	CarlsenS	8015 M
		4/12/01	Nitrogen(Ammonia)	15	mg/L	0.05	4/18/01	SzkarlatM	350.1
		4/12/01	Propylene Glycol	340	mg/L	3	4/16/01	CarlsenS	8015 M
		4/12/01	Sulfide,Total	<0.1	mg/L	0.1	4/16/01	SzkarlatM	9034
074953	Outfall 007	4/12/01	Ethylene Glycol	120	mg/L	3	4/16/01	CarlsenS	8015 M
		4/12/01	Nitrogen(Ammonia)	4.8	mg/L	0.05	4/18/01	SzkarlatM	350.1
		4/12/01	Propylene Glycol	210	mg/L	3	4/16/01	CarlsenS	8015 M
		4/12/01	Sulfide,Total	<0.1	mg/L	0.1	4/16/01	SzkarlatM	9034
074954	Outfall 008	4/12/01	Ethylene Glycol	<3	mg/L	3	4/16/01	CarlsenS	8015 M
		4/12/01	Nitrogen(Ammonia)	8.0	mg/L	0.05	4/18/01	SzkarlatM	350.1
		4/12/01	Propylene Glycol	<3	mg/L	3	4/16/01	CarlsenS	8015 M
		4/12/01	Sulfide,Total	<0.1	mg/L	0.1	4/16/01	SzkarlatM	9034
074955	Outfall 009	4/12/01	Ethylene Glycol	19	mg/L	3	4/16/01	CarlsenS	8015 M
		4/12/01	Nitrogen(Ammonia)	1.6	mg/L	0.05	4/18/01	SzkarlatM	350.1
		4/12/01	Propylene Glycol	<3	mg/L	3	4/16/01	CarlsenS	8015 M
		4/12/01	Sulfide,Total	<0.1	mg/L	0.1	4/16/01	SzkarlatM	9034

APPENDIX C

OUTFALL DISCHARGE RATES AND CONTAMINANT MASS LOADING CALCULATIONS

(Two Sheets)

CLEVELAND [illegible] MEASUREMENTS TAKEN ON 4-12-01

OUTFALL ØØ1 - CIRCLE

NOTES: USED GRADUATED BUCKET TO CAPTURE DISCHARGE

$\frac{2.0\,GAL}{2.2\,SEC} = \frac{1.0\,GAL}{1.1\,SEC} * \frac{60\,SEC}{MIN} =$ **54.6 GPM**

OUTFALL ØØ4

- DEPTH OF WATER = 2.4 INCHES * $\frac{1\,FOOT}{12\,INCHES}$ = 0.20 FEET
- WIDTH OF WATER = 22 INCHES * $\frac{1\,FOOT}{12\,INCHES}$ = 1.83 FEET

} 0.37 FT^2

Velocity = $\frac{6\,FEET}{10.60\,SEC}$ = 0.57 $\frac{FEET}{SEC}$ * $\frac{60\,SEC}{1\,MIN}$ = 33.96 $\frac{FEET}{MIN}$

Flow Rate = 12.57 $\frac{FT^3}{MIN}$ discharge = 12.57 $\frac{FT^3}{MIN}$ * $\frac{7.48\,GAL}{1\,FT^3}$ = **94.0 GPM**

OUTFALL ØØ5

- Depth of water = 2.5 inches * $\frac{1\,FOOT}{12\,inches}$ = 0.20 FEET
- Width of water = 26 inches * $\frac{1\,FOOT}{12\,inches}$ = 2.17 FEET

} 0.43 FT^2

Velocity = $\frac{6\,FEET}{2.38\,SEC}$ = 2.52 $\frac{FEET}{SEC}$ * $\frac{60\,SEC}{1\,MIN}$ = 151.20 $\frac{FEET}{MIN}$

Flow Rate = 65.02 $\frac{FT^3}{MIN}$ discharge = 65.02 $\frac{FT^3}{MIN}$ * $\frac{7.48\,GAL}{1\,FT^3}$ = **486 GPM**

OUTFALL ØØ7

- DEPTH OF WATER = 1.5 IN. * $\frac{1\,FT.}{12\,IN.}$ = 0.13 FT
- WIDTH OF WATER = 25 IN. * $\frac{1\,FT.}{12\,IN.}$ = 2.08 FT

} 0.27 FT^2

- Velocity = $\frac{6\,FEET}{2.38\,SEC}$ = 2.52 $\frac{FEET}{SEC}$ * $\frac{60\,SEC}{1\,MIN}$ = 151.20 $\frac{FT}{MIN}$

Flow Rate = 40.82 $\frac{FT^3}{MIN}$ discharge = 40.82 $\frac{FT^3}{MIN}$ * $\frac{7.48\,GAL}{1\,FT^3}$ = **305 GPM**

OUTFALL ØØ8

- Depth of water = .75 IN. * $\frac{1\,FT}{12\,IN.}$ = 0.06 FT
- Width of water = 13 IN. * $\frac{1\,FT}{12\,IN.}$ = 1.08 FT

} 0.06 FT^2

- Velocity = $\frac{6\,FEET}{2.45\,SEC}$ = 2.45 $\frac{FT}{SEC}$ * $\frac{60\,SEC}{1\,MIN.}$ = 149.00 $\frac{FT}{MIN}$
- Flow Rate = $\frac{8.82\,FT^3}{MIN}$ discharge = 8.82 $\frac{FT^3}{MIN}$ * $\frac{7.48\,GAL}{1\,FT^3}$ = **66.0 GPM**

OUTFALL ØØ9 - USED GRADUATED BUCKET

$\frac{4\,GAL}{11.0\,SEC} = \frac{1\,GAL}{2.75\,SEC} * \frac{60\,SEC}{MIN} =$ **21.9 GPM**

CLEVELAND HOPKINS INTERNATIONAL AIRPORT

OUTFALL 001 54.6 GPM * 3.78 = 206.20 LPM = DISCHARGE

AMMONIA = 10 mg/L * 10^{-3} = 0.01 g/L * $2.205 * 10^{-3}$ = 0.0000220 lbs/L * 206.20 L/M * 60 M/H * 24 H/DAY ≈ 6.5 lbs/day

ETHYLENE GLYCOL = 19 mg/L * 10^{-3} = 0.019 g/L * $2.205 * 10^{-3}$ = 0.0000418 lbs/L * 206.20 L/M * 60 M/H * 24 H/D ≈ 12.5 lbs/day

PROPYLENE GLYCOL = 193 mg/L * 10^{-3} = 0.193 g/L * $2.205 * 10^{-3}$ = 0.000389 lbs/L * 206.20 L/M * 60 M/H * 24 H/D ≈ 115 lbs/day

OUTFALL 004 94.0 GPM * 3.78 = 355.40 LPM = DISCHARGE

AMMONIA = 14 mg/L * 10^{-3} = 0.014 g/L * $2.205 * 10^{-3}$ = 0.0000287 lbs/L * 355.40 L/M * 60 M/H * 24 H/D ≈ 15 lbs/day

XYLENE & PROPYLENE GLYCOL - COMPOUNDS REPORTED < THE REQUIRED REPORTING LIMIT
∴ LOADINGS ARE NOT CALCULATED.

OUTFALL 005 486 GPM * 3.78 = 1,838.40 LPM = DISCHARGE

AMMONIA = 15 mg/L * 10^{-3} = 0.015 g/L * $2.205 * 10^{-3}$ = 0.000033 lbs/L * 1,838.40 L/M * 60 M/H * 24 H/D ≈ 87 lbs/day

XYLENE GLYCOL = 9.9 mg/L * 10^{-3} = 0.0099 g/L * $2.205 * 10^{-3}$ = 0.0000218 lbs/L * 1838.40 L/M * 60 M/H * 24 H/D ≈ 58 lbs/DAY

PROPYLENE GLYCOL = 340 mg/L * 10^{-3} = 0.340 g/L * $2.205 * 10^{-3}$ = 0.000749 lbs/L * 1838.40 L/M * 60 M/H * 24 H/D ≈ 1,985 lbs/day

OUTFALL 007 305 GPM * 3.78 = 1,154.15 LPM = DISCHARGE

AMMONIA = 4.8 mg/L * 10^{-3} = 0.0048 g/L * $2.205 * 10^{-3}$ = 0.0000105 lbs/L * 1,154.15 L/M * 60 M/H * 24 H/D ≈ 17 lbs/DAY

ETHYLENE GLYCOL = 120 mg/L * 10^{-3} = 0.120 g/L * $2.205 * 10^{-3}$ = 0.000264 lbs/L * 1,154.15 L/M * 60 M/H * 24 H/D ≈ 440 lbs/DAY

XYLENE GLYCOL = 210 mg/L * 10^{-3} = 0.210 g/L * $2.205 * 10^{-3}$ = 0.000463 * 1,154.15 L/M * 60 M/H * 24 H/D ≈ 769 lbs/DAY

OUTFALL 008 66 GPM * 3.78 = 249.37 LPM = DISCHARGE

AMMONIA = 8.0 mg/L * 10^{-3} = 0.008 g/L * $2.205 * 10^{-3}$ = .0000176 lbs/L * 249.37 L/M * 60 M/H * 24 H/D ≈ 6.3 lbs/DAY

XYLENE & PROPYLENE GLYCOL - COMPOUNDS REPORTED < THE REQUIRED REPORTING LIMIT
∴ LOADINGS ARE NOT CALCULATED

OUTFALL 009 21.8 GPM * 3.78 = 82.44 LPM = DISCHARGE

AMMONIA = 1.6 mg/L * 10^{-3} = 0.0016 g/L * $2.205 * 10^{-3}$ = 0.00000352 lbs/L * 82.44 L/M * 60 M/H * 24 H/D ≈ 0.381 lbs/DAY

XYLENE GLYCOL = 19 mg/L * 10^{-3} = 0.019 g/L * $2.205 * 10^{-3}$ = 0.0000418 lbs/L * 82.44 L/M * 60 M/H * 24 H/D ≈ 5.0 lbs/DAY

PROPYLENE GLYCOL - COMPOUND REPORTED < THE REQUIRED REPORTING LIMIT
∴ LOADING IS NOT CALCULATED